

About SPR and Distrib





United States
General Accounting Office
Washington, D.C. 20548

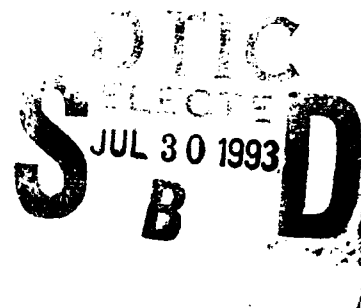
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Resources, Community, and
Economic Development Division

B-233820.5

November 28, 1990

The Honorable Mike Synar
Chairman, Environment, Energy,
and Natural Resources Subcommittee
Committee on Government Operations
House of Representatives



Dear Mr. Chairman:

This report responds to your May 15, 1989, request that we examine the Department of Energy's (DOE) SPR drawdown plans because of concerns about DOE's ability to meet its objectives for withdrawing and distributing SPR oil. The report suggests additional authority that the Congress may want to consider granting to prevent potential distribution problems and makes recommendations to the Secretary of Energy to (1) examine the effectiveness of the review process for requests for waivers of the requirement that U.S. vessels be used to transport SPR oil and (2) improve oversight of contractor compliance with pipeline safety requirements.

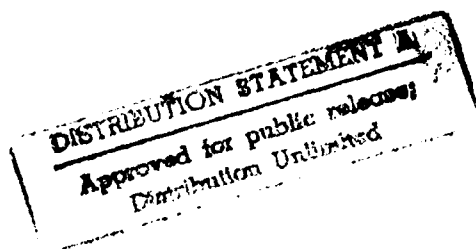
As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to the Secretary of Energy and other interested parties. We will also make copies available to others upon request.

This work was done under the direction of Victor S. Rezendes, Director, Energy Issues, (202) 275-1441. Other major contributors to this report are listed in appendix I.

Sincerely yours,


J. Dexter Peach
Assistant Comptroller General

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Executive Summary

Purpose

The current crisis in the Persian Gulf has brought renewed attention to the role of the Department of Energy's (DOE) Strategic Petroleum Reserve (SPR) in mitigating the effects of an oil supply disruption. The SPR provides insurance against future oil supply interruptions and the impact of such interruptions on the nation's economy. To provide this protection, however, DOE must be able to offset the supplies lost by quickly drawing down SPR oil from its storage sites and distributing it to purchasers.

At the request of the Chairman of the Environment, Energy, and Natural Resources Subcommittee of the House Committee on Government Operations, GAO examined DOE's SPR drawdown plans. Specifically, GAO was asked to (1) review DOE's current and planned capability for removing the oil from SPR sites and getting it to users through oil distribution networks, (2) examine the SPR's compliance with pipeline safety requirements, and (3) determine the status of DOE actions to correct problems GAO had previously reported.

Background

The SPR currently stores over 580 million barrels of crude oil in caverns and mines in salt domes in Louisiana and Texas. In an energy emergency, the oil will be sold to the highest bidders. SPR sites are connected to terminals with access to commercial distribution pipelines or to marine docks where the oil can be loaded onto barges or tankers for waterborne transportation. GAO has discussed drawdown and distribution problems in two previous reports: Evaluation of the Department of Energy's Plan to Sell Oil From the Strategic Petroleum Reserve (GAO/RCED-85-80, June 5, 1985) and More Assurance Is Needed That Strategic Petroleum Reserve Oil Can Be Withdrawn as Designed (GAO/RCED-85-104, Sept. 27, 1985).

Results in Brief

To achieve its purpose, SPR oil must be quickly and effectively introduced into the market. Any operational delays encountered in drawing down the SPR could lessen its impact on oil prices and thus on the U.S. economy. Currently, DOE estimates it can withdraw and distribute oil from the SPR at a maximum rate of about 3.5 million barrels a day. These estimates are based on the results of a number of drawdown and other system tests. In September 1990 DOE announced a sale of 5 million barrels of oil as a further test of the SPR. DOE expects delivery to begin in late October and last 30 to 45 days.

A major distribution could be hampered because buyers of SPR oil are required to use U.S.-flag tankers to transport the oil between U.S. ports. DOE and industry officials believe that not enough U.S.-flag vessels would be available, and questions remain about the efficiency of procedures to authorize the use of foreign vessels.

Problems with pipeline operations could also hamper an SPR drawdown. DOE attempts to comply voluntarily with Department of Transportation pipeline safety standards. However, DOE did not have a complete picture of the extent of overall compliance with these standards, and GAO found that the SPR was not in full compliance with certain standards related to inspections and records retention.

DOE has acted on previous GAO recommendations concerning (1) further testing of site drawdown capabilities, (2) testing the adequacy of water distribution systems to support drawdown at two sites, (3) resolving piping integrity and corrosion control concerns, and (4) completing automated control and integrated logistics support systems.

Principal Findings

Operational Problems Could Offset Expected Economic Impact of SPR Use

An SPR drawdown could help mitigate the effects of an oil supply disruption by keeping oil price increases lower than they would otherwise be. To achieve this, SPR oil must be quickly and effectively introduced into the market to replace lost supplies and ease market participants' concerns about supply shortages. Any problems encountered in drawing down the SPR could lessen its impact on oil prices. Based on the results of a DOE model used to analyze a hypothetical oil shortage of 4 million barrels per day lasting for one quarter, crude prices could be almost \$5 per barrel higher if the SPR were drawn down at 2.5 million barrels per day rather than at 3.5 million barrels per day.

Currently, DOE estimates that it can withdraw and distribute oil from the SPR at a maximum rate of about 3.5 million barrels a day. DOE's estimates of its drawdown capability are based on more realistic tests and analyses than those identified during the 1985 GAO drawdown review. DOE could maintain this rate for 90 days, after which the rate would gradually decline. If the SPR were drawn down at the maximum achievable rate, the bulk of the oil would be drawn down within 200 days.

Problems in Securing Marine Transportation Could Hamper Drawdown

According to a DOE official, at the maximum 3.5 million barrels per day drawdown rate, it is likely that between 40 and 50 percent of the oil would be moved by water. DOE and industry officials indicated that the number of U.S.-flag vessels available would be insufficient to move the portion of SPR oil planned for marine distribution at the higher drawdown rates.

DOE believes that enough foreign-flag vessels would be available to provide the additional capacity needed. However, to use foreign-flag vessels, oil purchasers would have to obtain Jones Act waivers from the Treasury Department. Although that agency, DOE, and the Maritime Administration have established an expedited waiver review process, this process has never been tested. Further, DOE and industry officials are concerned that the volume of waiver requests submitted during a large drawdown could overwhelm the system and lessen the economic impact expected from an SPR drawdown. During last winter's heating oil price spike, Treasury received six requests to allow the use of foreign vessels to transport heating oil and propane. The events occurred during the year-end holidays, and Maritime took from 1 to 7 days to provide information on the availability of qualified U.S.-flag ships. In two cases, the cargoes were shipped to foreign ports before a decision was received on the waiver request.

Giving the President standby authority to issue limited blanket waivers, which he could use if delays in the case-by-case waiver review process were slowing the SPR drawdown, could provide additional insurance for SPR use without unnecessarily jeopardizing the interests of the U.S. fleet.

Better Oversight of Compliance With Pipeline Safety Standards Needed

The SPR oil pipelines are the link between the storage sites and the commercial facilities (pipeline and marine terminals) that will be used to distribute oil from the SPR. Problems with pipeline operations during drawdown could slow or prevent distribution and result in severe economic and environmental impacts. While the Department of Transportation establishes and enforces pipeline safety standards for privately owned pipelines transporting crude oil, the SPR is not required to follow these standards.

DOE has established a policy of voluntary compliance and requires its contractors to adhere to the Department of Transportation's pipeline construction, maintenance, and operations standards. However, GAO's review of selected standards identified instances of noncompliance in calendar year 1989. For example, the contractor that operates the SPR

for DOE had not performed the right-of-way and corrosion control equipment inspections as frequently as required and was not retaining pipeline repair records for the useful life of the pipeline.

Further, no single DOE official was responsible for overseeing the extent to which the SPR complies with the pipeline safety standards. Instead, responsibility for the functions affected by the standards is spread over a large number of DOE and contractor offices. In October 1990 DOE designated an SPR Pipeline Manager with responsibility for operation, maintenance, and construction of all SPR pipelines. According to SPR officials the pipeline manager will also be responsible for ensuring compliance with the federal pipeline safety standards, but procedures for accomplishing this task have not yet been established.

DOE Acted on Prior GAO Recommendations

DOE has implemented several prior GAO recommendations. DOE's actions included (1) conducting 20 drawdown-related tests between 1986 and 1989, (2) developing a program to identify piping conditions and corrective actions needed, (3) completing automated controls designed to operate valves and pumps and monitor control equipment from a central control room, and (4) developing an integrated logistics support system to ensure an adequate supply of spare parts for a sustained drawdown period.

Recommendation to the Secretary of Energy

GAO recommends that DOE (1) develop a realistic test of the effectiveness of the expedited waiver review process under various SPR drawdown conditions and rates and (2) ensure that procedures and information systems are developed to monitor contractor compliance with pipeline safety standards.

Matter for Congressional Consideration

Because of the likelihood that Jones Act waivers will be needed to move SPR oil expeditiously and the uncertainty about prompt action under the current waiver review process, the Congress may wish to consider granting standby authority allowing the President to issue a blanket waiver to the Jones Act requirement if delays resulting from the case-by-case review process are limiting DOE's ability to draw down the SPR.

Agency Comments

As requested, GAO did not obtain official agency comments on a draft of this report. However, GAO did meet with agency officials and has made changes based on their comments where appropriate.

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Abbreviations

DOE	Department of Energy
DOT	Department of Transportation
GAO	General Accounting Office
NPC	National Petroleum Council
SPR	Strategic Petroleum Reserve

Introduction

The oil supply disruptions of the 1970s demonstrated the severe economic distress that can occur when even a portion of oil imports are threatened or interrupted. In 1975 the Congress, concerned about the effects of oil import disruptions, authorized a Strategic Petroleum Reserve (SPR). The SPR currently contains over 580 million barrels of crude oil. To accomplish the SPR's intended purpose of replacing any lost oil supplies in the event of supply disruptions and thus reducing any related economic impacts, the Department of Energy (DOE) must be prepared for a timely withdrawal (drawdown) and distribution of SPR oil.

In a letter dated May 15, 1989, the Chairman of the Environment, Energy, and Natural Resources Subcommittee of the House Committee on Government Operations asked us to examine DOE's SPR drawdown plans because of concerns about DOE's ability to meet its objectives for withdrawing and distributing SPR oil. Based on the request letter and subsequent discussions with the requester's office, our specific objectives were to (1) review DOE's current and planned capability for removing the oil from SPR sites and getting it to users through oil distribution networks, (2) determine whether the SPR is required to comply with federal pipeline safety standards, and (3) determine the status of DOE actions to correct drawdown problems previously reported, particularly concerns about the adequacy of DOE's testing program.

SPR Development

The SPR, created by the Energy Policy and Conservation Act (Public Law 94-163, Dec. 22, 1975, as amended), is intended to supplement U.S. industry stocks and supplies, thereby mitigating the effects of any supply disruption on the national economy and reducing the nation's vulnerability to such disruptions. Further, the SPR helps the United States meet its commitment, as a member of the International Energy Agency, to maintain a reserve equal to 90 days of net oil imports.¹

As initially planned in February 1977, the SPR was to be large enough to offset the highest amount of oil imported during a consecutive 3-month period in 1974-75, or approximately 500 million barrels, and the storage sites were to be designed to permit drawdown of the reserve within 150 days. The plan also provided for SPR storage of crude oil in underground caverns or mines located in salt domes in Louisiana and Texas. Because of an increase in U.S. petroleum imports during 1977 and revised estimates of future import levels, the SPR plan was amended in May 1978 to

¹Net oil imports are total imports minus exports.

provide for storage of 750 million barrels of oil. Table 1.1 shows the current and planned oil storage by site.

Table 1.1: DOE's Current and Planned Oil Storage at SPR Sites as of December 31, 1989

Barrels in Millions		
Storage site	Oil inventory	
	Current	Planned
Bryan Mound	221	226
West Hackberry	206	219
Sulphur Mines	25 ^a	0
Big Hill	1 ^b	160
Bayou Choctaw	54	72
Weeks Island	73	73
Total	580	750

^aDOE plans to increase capacity at Big Hill and Bayou Choctaw to replace this site, which is scheduled to be decommissioned in 1992.

^bThis oil was used for cavern development purposes. Oil fill of the first cavern began in June 1990.

The Energy Policy and Conservation Act Amendments of 1990, enacted in September 1990, extend SPR authorization to September 30, 1994, and require DOE to develop plans to increase SPR storage to 1 billion barrels of petroleum product and to test mechanisms for storing refined petroleum products. In addition, the amendments authorize (1) SPR use for disruptions in domestic oil supplies, (2) suspension of SPR acquisitions and sale of purchases already en route when severe energy supply interruptions are imminent, (3) leasing of petroleum products and storage facilities for the SPR, and (4) sale of up to 5 million barrels of SPR oil as part of a test drawdown.

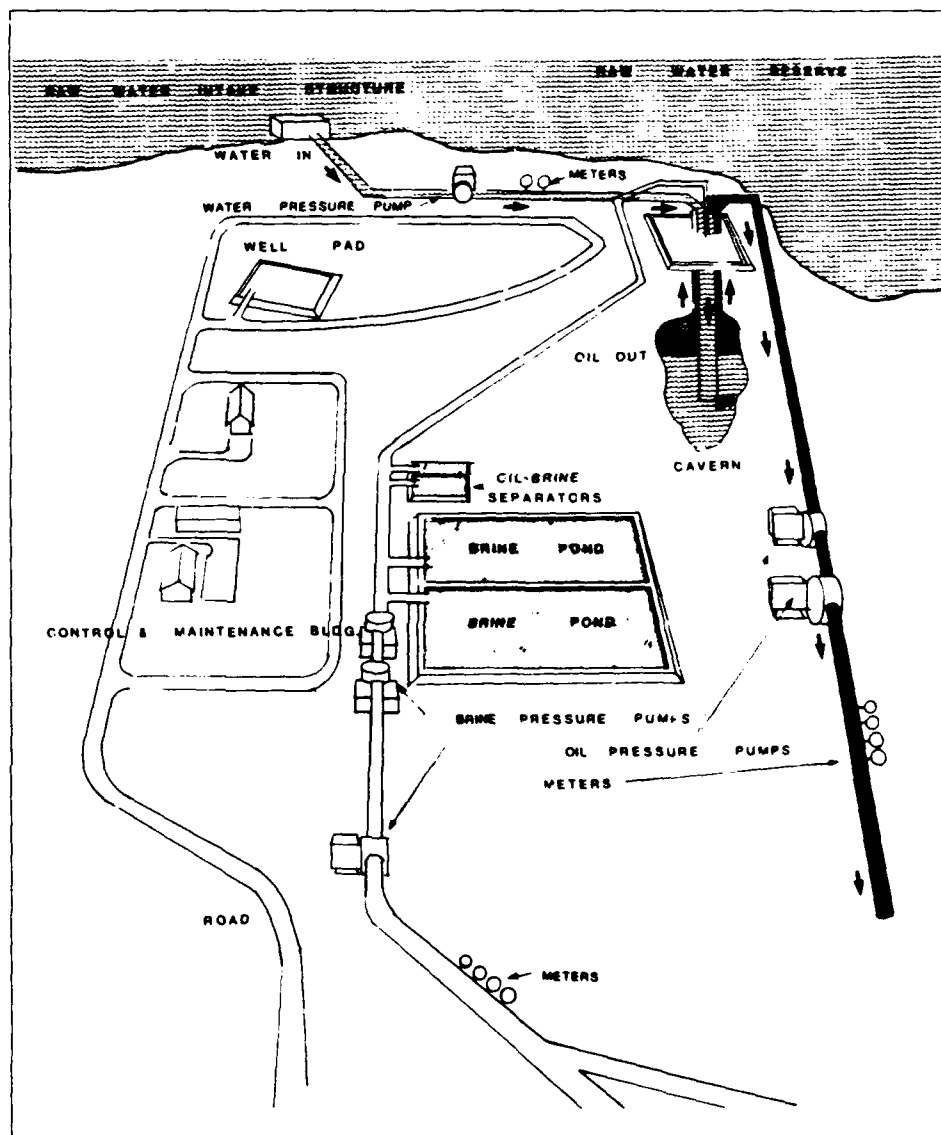
DOE's October 31, 1979, SPR distribution plan (as required by the Energy Policy and Conservation Act) describes the methods for withdrawing and distributing crude oil from SPR storage sites. As directed by the Energy Emergency Preparedness Act of 1982, in December 1982 DOE developed a second distribution plan which provided that the principal method of distributing SPR oil would be price-competitive sales: oil would be sold to the highest bidders. The sale would be open to the largest possible number of eligible buyers to ensure efficient distribution of SPR oil.

With the exception of the Weeks Island site, the process used to draw down the caverns is very similar to the leaching process used to create

the storage caverns in the salt deposits.² During drawdown, water is pumped into the bottom of the caverns, forcing the oil out through the top into the on-site piping. (See fig. 1.1.) Because fresh water is used, the drawdown process will enlarge the caverns by dissolving additional amounts of salt. DOE-constructed caverns were designed to withstand at least five drawdowns without threatening cavern integrity. Oil stored in the Weeks Island site, which is located in a former salt mine, must be pumped out using submerged pumps. From the on-site piping the oil is pumped through DOE pipelines to terminals connected to commercial distribution pipelines or to marine docks where it can be loaded onto crude oil barges or tankers for waterborne transportation to refineries.

²In the leaching process, fresh water is pumped into salt deposits. The water dissolves the salt, forming brine. Removing the brine leaves a cavity which can be used for crude oil storage.

Figure 1.1: Fluid Flow During Drawdown

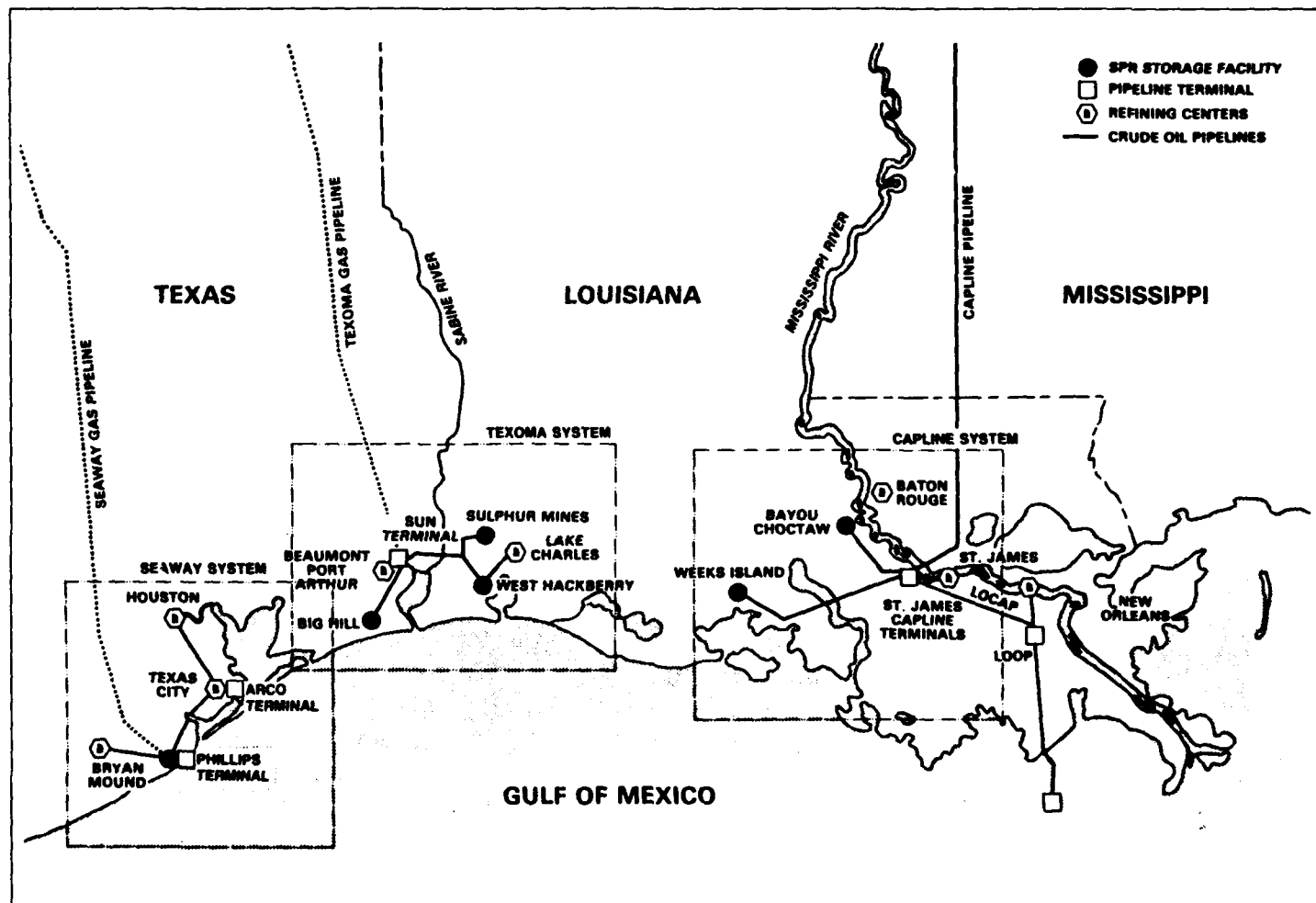


Source: Department of Energy

The SPR storage sites are connected to pipelines that can be used to move SPR oil directly to 41 refineries as well as 4 marine terminals, where the oil can be loaded onto tankers or barges for transport to other refineries. The sites are configured in three complexes. (See fig. 1.2.) It is up to the purchaser to select the delivery route and make arrangements to move the oil to the refinery where it will be processed.

- Seaway Complex: The Bryan Mound storage site is connected to Phillips Petroleum Company's terminal in Freeport, Texas, and to the ARCO terminal in Texas City, Texas. These terminals provide connections to two marine terminals and nine refineries in Texas.
- Texoma Complex: The West Hackberry, Sulphur Mines, and Big Hill sites are connected to the Sun Pipe Line Company's terminal in Nederland, Texas. This terminal provides access to five refineries in Texas and Arkansas, a marine terminal, and a pipeline that can be used to reach six refineries in Kentucky, Michigan, and Ohio. The West Hackberry site is also connected to a pipeline with access to three refineries in Louisiana and Texas, and DOE is preparing a request for proposals to provide additional distribution capacity for this complex.
- Capline Complex: The Weeks Island and Bayou Choctaw storage sites are connected to DOE's St. James marine terminal; the LOCAP terminal, with access to two Louisiana refineries; and the Capline Terminal, with access to an interstate pipeline that can be used to distribute oil to 22 refineries in the central part of the United States, including the 6 refineries also served by the Texoma complex.

Figure 1.2: Strategic Petroleum Reserve Complexes and Associated Pipelines and Terminals



Source: Department of Energy.

Recent Events Have Focused Renewed Attention on the SPR

The rapid increases in crude oil and gasoline prices after Iraq's August 1990 invasion of Kuwait have brought attention to the role of the SPR. The oil market's reaction to the invasion also demonstrated that the price and economic impacts of an oil disruption can begin immediately. The embargo on trade with both countries imposed by the United Nations Security Council interrupted crude oil imports by the United States and other countries. In 1989, Iraq and Kuwait collectively produced an average of 4.6 million barrels of oil per day. This represented about 7.8 percent of worldwide oil production. After the August 1990 invasion, increased demand, perceptions of shortages, and expectations of higher future prices almost immediately resulted in increased prices

for oil and petroleum products. Between August 1 and September 28, the price for oil futures on the New York Mercantile Exchange increased from \$21 per barrel to almost \$40 per barrel. Surveys conducted by the American Automobile Association showed that during the same period average gasoline prices rose almost 25 cents per gallon.

DOE's Organizational Structure for SPR Management

DOE's SPR Program Office in Washington, D.C., is responsible for overall program management and planning for achieving the goals and objectives of the SPR program. Responsibility for SPR project management and implementation is assigned to the Oak Ridge Operations Office in Oak Ridge, Tennessee. The Operations Office has delegated these activities to the Project Management Office (Project Office) in New Orleans, Louisiana. Under an 8-year management and operations contract, Boeing Petroleum Services, Inc., provides the personnel and services needed to run the government-owned SPR facilities. DOE retains responsibility for overall project management and technical direction, while Boeing, the operating contractor, is responsible for the SPR's day-to-day management.

Scope and Methodology

To review DOE's current and planned capability for withdrawing and distributing SPR oil, we obtained information from SPR officials in Washington, D.C., and New Orleans, Louisiana. We analyzed drawdown and distribution plans, reviewed the mathematical models used to estimate drawdown and distribution capabilities, and examined storage development plans and reports. To get an indication of the potential benefits of an SPR drawdown, we also used a DOE model, the Disruption Impact Simulator, to estimate the potential impacts of selected SPR drawdowns on crude oil prices, the Gross National Product, and other economic indicators. We did not, however, conduct a detailed evaluation of the model.

At the recommendation of the National Petroleum Council (NPC), we discussed the SPR oil distribution system with representatives of Mobil Oil Corporation in Fairfax, Virginia, and Shell Oil Company in Houston, Texas. We also reviewed a recent NPC study of the industry's oil pipeline distribution system in which Mobil and Shell participated.

We discussed the procedures for processing waivers to allow the use of foreign-owned tankers to transport SPR oil with DOE and Maritime Administration officials in Washington, D.C. We obtained estimates from SPR officials on the number of ships that would be needed for an SPR

drawdown and reviewed their calculations of the number of U.S. tankers that might be available to transport SPR oil.

To determine whether the SPR is required to comply with federal pipeline safety standards, we discussed the applicability of Department of Transportation (DOT) hazardous liquid pipeline safety standards to the SPR's pipelines with SPR officials in New Orleans, Louisiana, and DOT's Office of Pipeline Safety officials in Washington, D.C., and Houston, Texas. We also discussed pipeline industry standards and inspection practices with the Mobil and Shell representatives. We examined information on SPR compliance with pipeline industry standards obtained from DOE officials in Washington, D.C., and New Orleans, Louisiana, and reviewed pipeline inspection plans and reports.

To determine the status of DOE actions to correct drawdown problems previously reported, we obtained information from SPR officials in New Orleans, Louisiana, on the status of the SPR automated control and integrated logistics support systems, examined reports on SPR drawdown tests and inspections to determine the integrity of SPR pipelines. We also discussed the adequacy of the SPR's drawdown testing with the Mobil and Shell representatives.

This work was performed from May 1989 to September 1990 in accordance with generally accepted government auditing standards. We discussed the accuracy of the information presented in this report with responsible agency officials and have incorporated their comments where appropriate. However, as requested, we did not obtain official agency comments.

DOE's Estimates of Current Drawdown Capability Appear Reasonable, but Tanker Availability Could Affect Distribution

Uncertainty resulting from the current situation in Iraq and Kuwait has brought renewed attention to SPR operational concerns. Operational delays that limit an SPR drawdown could lessen the economic impact of using the SPR.

DOE estimates that it can currently withdraw and distribute oil from the SPR at a maximum sustainable rate of approximately 3.5 million barrels per day. Although in the past we have questioned DOE's drawdown estimates, we believe that DOE's current estimates are more realistic because it has conducted a number of drawdown and other system tests and adjusted rates to reflect actual performance. Although these tests were still of limited volume and duration, in late September 1990, DOE announced a sale of 5 million barrels as a test of the SPR system.

DOE will not be able to reach its drawdown goal of 4.5 million barrels per day until the planned drawdown and distribution enhancements are completed and enough oil is stored at the Big Hill site to support its planned drawdown rate.

While DOE has improved its capability considerably since 1985 when we last reported on drawdown,¹ insufficient availability of tankers could still hamper SPR drawdown and distribution. Buyers of SPR oil are required to use U.S.-flag tankers to transport the oil between U.S. ports, but DOE and oil industry officials believe that there will not be enough U.S. tankers available to move the amount of oil that must be moved by marine distribution at the higher drawdown rates. The agencies involved have agreed to an expedited review process for Jones Act waiver requests, but questions remain about the effectiveness of the process.

Questions Raised About Possible Limitations on SPR Drawdown Process

The volatility in the oil markets since Iraq's invasion of Kuwait has brought renewed attention to the SPR and the key role it plays in an energy emergency. Media and industry officials have again raised questions about whether the SPR drawdown system can operate as planned to quickly and reliably deliver the oil. This issue is of vital importance because it could limit the extent to which the SPR can be used to offset supply disruptions and the resulting economic impacts.

¹ More Assurance Is Needed That Strategic Petroleum Reserve Oil Can Be Withdrawn as Designed (GAO/RCED-85-104, Sept. 27, 1985).

In a 1985 report we noted that a number of studies indicate that, in a disruption, an SPR drawdown would keep price increases lower than they would otherwise be.² The SPR, however, can accomplish this objective only if the oil is quickly and effectively introduced into the market to replace lost supplies and reduce market participants' concerns about future supply shortages. In both the current and previous disruptions, some have argued that oil prices have risen further than would be expected from the actual supplies lost. One explanation is that expectations about rising prices and fears that the disruption will worsen may lead oil market participants to accumulate oil stocks. This could lead to further supply shortages and increased prices.

As a result, any delays encountered in drawing down the SPR could lessen its potential impact, particularly if such delays increase market participants' uncertainties about future supplies.

To get an indication of the potential benefits of an SPR drawdown, we used a DOE model, the Disruption Impact Simulator, to estimate the potential impacts on crude oil prices, the Gross National Product, and other economic indicators, of selected SPR drawdowns. We examined drawdowns of 2.5 and 3.5 million barrels per day related to a hypothetical disruption of 4 million barrels per day lasting one quarter only. As shown in table 2.1, the model predicts that during that quarter crude prices could be almost \$5 per barrel higher if the SPR drawdown rate is 2.5 million barrels per day than if it is 3.5 million barrels per day.³

²Evaluation of the Department of Energy's Plan to Sell Oil From the Strategic Petroleum Reserve, (GAO/RCED-85-80, June 5, 1985).

³It should be noted that although table 2.1 shows impacts only for the particular quarter in which the disruption occurred, the model results indicate impacts for subsequent quarters as well.

Table 2.1: Impacts Predicted for a
Disruption of 4 Million Barrels Per Day for
One Quarter

	SPR daily drawdown rate			
	Base case assumptions (no disruption)	3.5 million barrels	2.5 million barrels	None
Petroleum prices:				
Crude oil (per barrel)	\$18.00	\$19.89	\$24.36	\$39.83
Gasoline (per gallon)	1.13	1.17	1.28	1.65
Heating oil (per gallon)	0.86	0.90	1.01	1.38
Economic impact (percents) ^a :				
Decrease in GNP	^b	-0.25	-0.75	-1.97
Increase in unemployment	^b	0.10	0.30	0.79
Increase in inflation	^b	0.37	1.13	2.95

Note: Impacts only for the quarter during which the disruption occurred.

^aAnnualized rates.

^bNot applicable.

These results must be used cautiously because the DOE model is a simplified tool for analyzing very complex relationships. The model does not explicitly account for interactions between the oil market and related markets such as the natural gas market.⁴ Such interactions may mitigate the impacts of oil supply disruptions and result in additional impacts on the economy. The model also does not explicitly account for market participants' expectations about future events, which may have important economic ramifications in an oil supply disruption. Hence, the model results presented in table 2.1 as the impacts of an SPR drawdown should be viewed as a rough estimate.

Drawdown and Distribution Capability Estimated at 3.5 Million Barrels Per Day

As of December 31, 1989, DOE estimated the maximum rate for SPR drawdown and distribution to be 3.5 million barrels per day. (See table 2.2.) These rates could be sustained for 90 days, after which the balance of the SPR's inventory could be withdrawn at gradually decreasing rates as the inventory was depleted. At the current maximum rate, the bulk of SPR oil would be drawn down in about 200 days. The maximum daily drawdown rate for the SPR will be gradually increased to 4.5 million barrels as the reserve is filled to the 750-million-barrel level.

⁴For example, the model does not calculate the amount of fuel switching that might result. In setting up the assumptions to be used in the model, the user can, however, specify an amount for reduced oil demand resulting from fuel switching.

As discussed in chapter 1, the SPR was designed to permit drawdown of the planned 750 million barrels of oil within 150 days. Each storage site's caverns, pumps, and piping were designed to contribute a specified portion of this drawdown capability. Over time, DOE has adjusted these rates because of factors such as changes in the industry's crude oil distribution network and the decision to decommission Sulphur Mines. Table 2.2 shows DOE's goals for each site's maximum drawdown capability—both for the amount of oil stored in the SPR as of December 31, 1989, and after the reserve has reached 750 million barrels of oil.

Table 2.2: DOE's Current and Planned Maximum Drawdown Rates at SPR Sites as of December 31, 1989

Complex/site	Maximum daily drawdown goal	
	Current	Planned
Barrels in Millions		
Seaway		
Bryan Mound	1.10	1.25
Texoma		
West Hackberry	1.25	1.25
Sulphur Mines	.10	^a
Big Hill	^a	.93
	1.35	2.18
Capline		
Bayou Choctaw	.48	.48
Weeks Island	.59	.59
	1.07	1.07
SPR total	3.52	4.50

^aNot applicable.

How DOE Determines Drawdown and Distribution Capabilities

DOE bases its drawdown estimates on predictions from several mathematical models that are based on performance data gathered in drawdown tests at SPR sites. Although, as discussed in chapter 4, we questioned DOE's estimates of its drawdown capability in our 1985 drawdown report, we believe DOE's current estimates are more realistic because DOE has conducted a number of drawdown and other system tests. A certain amount of inherent uncertainty can never be removed because it would be impossible to simulate in a test situation an actual drawdown that would have to be sustained for several months. Although the tests conducted by DOE have been of relatively short duration, they have physically tested the SPR drawdown system, and the use of data on actual operations provides greater assurance that estimated drawdown capabilities can be achieved. Further, on September 27, 1990,

DOE announced a sale of 5 million barrels as a test of the SPR that will allow the private sector to increase its familiarity with the process for distributing SPR oil. Finally, DOE has also implemented several other recommendations we made in 1985, and thus provided further assurance regarding the accuracy of the drawdown predictions.

DOE's distribution strategy for the SPR relies on the marketplace to determine how to get the oil where it is needed. DOE's responsibility ends when the oil has been delivered to the pipeline or marine terminal, where custody transfers to the buyer. DOE does, however, analyze the commercial transportation network to ensure that the available capacity is adequate to distribute SPR oil.

DOE currently estimates that a maximum of about 2.5 million barrels per day could be distributed by pipeline, using a model containing data on the 41 refineries that could receive oil from the SPR by pipeline. The model estimates potential demand for SPR oil based on the amount of imported oil historically processed by these refineries. The model calculates what portion of the imports could be replaced by SPR oil considering physical constraints such as pipeline size and available interconnections.

DOE estimates current maximum marine distribution capability at about 2.1 million barrels per day. This is determined by the volume of oil that can be moved through the marine terminals and across docks to ships or barges. Except for the St. James terminal, which is owned and operated by DOE, DOE has multi-year contracts to use three commercial marine terminals in Texas for oil fill and withdrawal.

The portion distributed by either method will, of course, depend on the purchasers. If as much oil as possible is moved by pipeline, that method would account for about 70 percent of a drawdown at the maximum 3.5 million barrels per day rate, leaving 30 percent to be transported by water. Conversely, if water transportation is used to move as much of the oil as possible, it would account for approximately 60 percent of the drawdown, leaving 40 percent to be distributed by pipeline.

Some Drawdown Limitations Identified at Bryan Mound

Tests at Bryan Mound identified water system limitations that affected the site's ability to meet its drawdown goal of 1.1 million barrels per day. DOE is currently constructing facilities at Bryan Mound that should raise its drawdown capability to 1.25 million barrels per day. These enhancements will (1) correct the water system limitations that prevent

attainment of the 1.1-million-barrels-per-day rate and (2) increase the drawdown capability by another 150 thousand barrels per day to offset the West Hackberry rate reduction.⁵ The water system enhancements include an additional water-intake line, larger pump impellers in existing pumps, and an additional water booster pump and water injection pump to increase the water flow rates. DOE expects to complete these enhancements in 1991.

Measures Needed to Achieve a 4.5-Million- Barrel-Per-Day Rate

To increase drawdown capability from the current 3.5-million-barrel-per-day rate to the planned 4.5-million-barrel-per-day rate, DOE needs to (1) complete construction of the water and oil transportation system enhancements at Bryan Mound mentioned above, (2) finish leaching caverns at Bayou Choctaw and Big Hill, and (3) store enough oil at the Big Hill site to support its planned drawdown rate. DOE expects to complete cavern leaching at Bayou Choctaw and Big Hill in September 1991.

DOE still faces some uncertainties in increasing the SPR's distribution capability from the current 3.5-million-barrels-per-day rate to the planned 4.5-million-barrels-per-day rate. Additional distribution capacity will be needed in the Texoma complex. In 1988 and 1989 DOE tried to acquire additional distribution capacity in the Lake Charles, Louisiana, and Beaumont/Port Arthur, Texas, areas, but did not receive any acceptable proposals. DOE is currently revising its plans for a 1990 solicitation. This request will solicit a combined pipeline and marine distribution capacity of 700,000 barrels per day and be open to any terminals or pipelines that can be readily connected to Texoma facilities.

Because drawdown capability will not exceed current distribution capabilities for several years, DOE officials believe they have time to find a solution to the problem. They also believe that changes in the oil industry might create other distribution alternatives. For example, with the decrease in domestic production since 1985, refineries are processing more imported oil. DOE is monitoring these events, and as capacity is added to distribute imported oil to different parts of the country, DOE plans to examine ways to connect into these distribution networks.

⁵Because tests showed that West Hackberry could sustain a drawdown rate of only 1.3 million barrels per day and excess distribution capacity existed in the Seaway complex, DOE decided to reduce West Hackberry's drawdown goal from 1.4 to 1.25 million barrels per day and increase Bryan Mound's goal.

Insufficient Number of U.S. Vessels to Distribute SPR Oil at Higher Drawdown Rates

DOE and industry officials indicated the number of U.S.-flag vessels available to move the SPR oil would be insufficient to move the portion of the SPR oil planned for marine distribution at the higher drawdown rates. Estimates of the point at which problems would occur ranged from 2 to 3 million barrels per day. Under the Jones Act buyers of SPR oil are required to use U.S.-flag vessels to transport the oil between U.S. ports.⁶ To supplement the U.S.-flag vessels, oil purchasers would have to obtain Jones Act waivers allowing them to use foreign-flag vessels. Waiver requests can be granted by the Treasury Department after consultation with the Maritime Administration, Department of Defense, and Department of Energy.

Uncertainty exists as to whether the current case-by-case waiver process will ensure that vessels are available as needed for SPR distribution. Blanket waiver authority to suspend the Jones Act requirement for an SPR drawdown would increase the likelihood that purchasers of SPR oil will be able to transport the oil from marine distribution terminals in a timely manner, and allow the SPR to accomplish its intended purpose.

More Ships Needed Than U.S. Fleet Can Supply

The availability of vessels to move SPR oil from marine terminals to refiners is a critical element in DOE's plans to mitigate the effects of an oil supply disruption. As noted, from about 30 to 60 percent of DOE's current 3.5-million-barrels-per-day distribution capability could be moved by water. A DOE official pointed out, however, that waterborne distribution is more likely to range between 40 and 50 percent of the drawdown. DOE will also solicit an additional 700,000 barrels per day of combined marine and pipeline distribution capability for its Texoma complex. Without the ability to move oil quickly through distribution networks, the economic benefits to the nation of using the SPR during an oil supply disruption would be decreased.

The Director of DOE's SPR office forecasts that the number of U.S. ships available would probably be insufficient for drawdowns exceeding 3 million barrels a day. An oil industry official said that he believed there would be a shortage of U.S.-flag ships during drawdowns of even 2 million barrels per day. At the planned 4.5-million-barrels-per-day rate, Boeing Petroleum Services, the SPR operating contractor, estimates that between 75 and 90 tankers would be needed. Based on conditions in

⁶The Jones Act (Section 27 of the Merchant Marine Act of 1920 (46 U.S.C. app. 883)) promotes the continued existence of a fleet of U.S.-flag vessels because of its importance for national defense—in a war it would be needed to move military supplies abroad.

1990, however, the contractor calculated that only 36 to 40 U.S. tankers would be available to transport the SPR oil.⁷

If waivers are obtained to allow foreign-flag tankers to be used, the SPR contractor believes enough ships would be available to make up for the anticipated shortage of U.S. vessels. This conclusion was based on the number of foreign-flag tankers delivering crude oil to the east coasts of western hemisphere countries in 1987.

Uncertainty Remains About Effectiveness of the Expedited Waiver Process

Under the Jones Act, purchasers of SPR oil must use U.S.-flag vessels to transport SPR oil between U.S. ports. In the interest of national defense and if U.S.-flag vessels are not available, the Department of Treasury can waive this requirement. Waivers are considered on a case-by-case basis. As part of the waiver request process, the Maritime Administration provides information to the Treasury Department on the availability of U.S.-flag vessels. In our 1985 report, we discussed the potential shortage of U.S.-flag ships and the waiver process, and reported that the National Petroleum Council had recommended that the Maritime Administration develop a contingency plan to expedite Jones Act waivers.⁸

In 1987 DOE, the Treasury Department, and the Maritime Administration entered into an interagency agreement providing for expedited review of waiver requests associated with an SPR oil drawdown. If this process operates as designed, the Treasury Department should be able to issue a decision on a request within 3 business days. The agreement provides for early and frequent exchanges of information among the agencies involved and establishes a goal of 2 business days for the Maritime Administration to review the availability of U.S. vessels to transport the oil and advise the Treasury Department whether or not the waiver should be granted. According to an official of the Treasury Department's Customs Service, Treasury cannot act on the waiver request until Maritime responds. Therefore, the decision will be delayed if Maritime is not able to provide this information within the allowed 2 days.

According to DOE and Maritime officials, the expedited waiver agreement for SPR cargoes has never been tested, and delays such as those

⁷The exact number of ships will vary depending on the circumstances. In estimating the number of available ships in 1990, the contractor eliminated those U.S. vessels that are too large to use the SPR docks, those out of service for repairs, and those currently involved in transporting refined products and domestic crude oil—since those activities would continue during a disruption.

⁸GAO/RCED-85-80, June 5, 1985.

experienced during the 1989-1990 home heating fuel price spike could have a serious impact on an SPR drawdown. Over an 8-day period in December 1989, Treasury received six requests to allow the use of foreign vessels to move cargoes of heating oil and propane to the Northeast of the United States. Although not covered by the SPR interagency agreement, the review process followed was similar. The events occurred during the year-end holidays, and Maritime took from 1 to 7 days to provide information on the availability of qualified U.S.-flag ships. In two cases, the cargoes were shipped to foreign ports before a decision was received on the waiver request.⁹

Agencies Differ on Need for Blanket Waiver Authority

To ensure that the transportation needed in an SPR drawdown is available, DOE and oil company officials have called for blanket authority to waive the Jones Act requirement. Officials of DOE and the Maritime Administration differ on the need for blanket waiver authority, but both agree that exercising such a waiver could mean that U.S. vessels might be excluded from transporting any of the SPR oil because of their higher costs.

The Director of DOE's SPR office believes the waiver process would be the most significant problem during a drawdown of 3 million barrels a day or larger. In his opinion, the case-by-case waiver process established by the interagency agreement would become overloaded with requests for waivers. Delays in the drawdown resulting from a shortage of ships to distribute the oil would work against the U.S. policy of drawing down the SPR early at a maximum rate for maximum impact. Blanket waiver authority would increase the likelihood that the desired economic impact of distributing SPR oil could be achieved.

Officials of the Maritime Administration, however, believe that the expedited waiver process will ensure that distribution of SPR oil will not be delayed. According to a Maritime official, their main task is to determine the status of about 100 ships, and this can be accomplished through a survey of vessel availability within the 2 business days provided for in the agreement. The official stated that the work can be intense initially, but quickly evolves into a series of repetitive actions. Although he could not estimate how many waiver requests might be received during an SPR drawdown, he did not believe he or his staff of

⁹Subsequent to the crisis, an interagency agreement was developed for dealing with future energy crises. The agreement is similar to the one for SPR drawdowns. We are preparing a report on the possible consequences of that agreement on the Jones Act waiver process in the event of another home heating fuel price spike. In that report we plan to address possible policy options.

seven employees would be overloaded. However, the experiences of last winter's fuel price spike illustrate that Maritime's task is not always as simple as surveying 100 vessels. Burdens on the staff increase when the people filing the waiver requests do not understand the process or do not provide all the information needed to determine whether a U.S. vessel might be available to move a particular cargo.

Standby authority for limited blanket waivers that the President could use if the case-by-case waiver review were slowing the SPR drawdown could provide additional insurance for SPR distribution without unnecessarily jeopardizing the interests of the U.S. fleet. If such authority does not exist before a disruption occurs, the effectiveness of the SPR drawdown could be severely affected because it is unlikely that action could be taken quickly enough to prevent delays in obtaining the necessary vessels.

Conclusions

Delays during drawdown could limit the economic impact expected from using the SPR. Because DOE's estimates of its current capabilities for withdrawing and distributing SPR oil are based on a number of drawdown and other system tests, we believe they provide more assurance that DOE will be able to achieve these rates during an actual drawdown. DOE will not be able to achieve the drawdown goal of 4.5 million barrels per day until several drawdown and distribution enhancements are completed and further oil fill is completed at the Big Hill site.

One issue that could affect DOE's ability to use the SPR successfully to offset the impacts of an oil supply disruption is whether purchasers of SPR oil will be able to obtain the tankers needed to move the portion of the oil that must be moved by marine transportation.

Waivers of the Jones Act requirement regarding use of U.S.-flag ships are likely to be needed for SPR drawdowns exceeding 3 million barrels a day, and questions have been raised about whether the interagency agreement will expedite the waiver review process. Because the agreement has not yet been tested, the delays experienced in acting on Jones Act waiver requests during last winter's home heating fuel price spike could portend similar problems in the event of an SPR drawdown exceeding 3 million barrels a day.

While officials disagree about the need for a blanket waiver of the requirement that U.S. vessels be used to transport SPR oil, uncertainty

exists as to whether the case-by-case review process will work effectively. Standby authority for limited blanket waivers could provide additional insurance for effective SPR distribution without unnecessarily jeopardizing the interests of the U.S. fleet.

Recommendation

To examine the effectiveness of the expedited waiver review process, we recommend that the Secretary of Energy direct the Assistant Secretary for Fossil Energy to work with the Maritime Administration and the Treasury Department to develop a realistic test that would simulate agency actions to process the number and type of waiver requests expected during SPR drawdowns of various rates.

Matter for Consideration by the Congress

Because of the likelihood that Jones Act waivers will be needed to move SPR oil expeditiously and the current uncertainties about whether the waiver review process will ensure prompt action on individual waiver requests, the Congress may wish to consider granting standby blanket waiver authority that would allow the President to waive the Jones Act requirement if delays resulting from the case-by-case review process were limiting DOE's ability to draw down the SPR.

Better Oversight Needed of Contractor Compliance With Pipeline Safety Standards

The SPR oil pipelines are critical to DOE's drawdown plans because they provide the link between the storage sites and the commercial facilities (pipeline and marine terminals) that will be used to distribute oil from the SPR. Problems with pipeline operations during drawdown could slow or prevent drawdown and could have severe economic and environmental impacts. DOT promulgates and enforces safety standards regulating the transportation of hazardous liquids by privately owned pipelines. Although the SPR is not required by law to comply with these standards, DOE has established a policy of voluntary compliance.

Most functions related to the construction, maintenance, and operation of the SPR are carried out by contractors. Although DOE has imposed DOT's pipeline safety standards on the SPR contractors, we believe DOE is responsible for overseeing the contractors to ensure compliance. We found, however, that no single DOE official or office had a comprehensive overview of the extent to which the SPR complies with DOT's standards. Although DOE and contractor officials believe that current SPR operations meet the DOT standards, our review of selected standards identified instances of noncompliance in calendar year 1989.

DOE's Compliance With Pipeline Safety Standards Is Voluntary

The nation's pipeline safety standards, issued by DOT's Office of Pipeline Safety, cover the transportation by privately owned pipelines of hazardous liquids, including crude oil, associated with interstate or foreign commerce (49 C.F.R. 195). The standards require timely accident reporting and spell out criteria for the design, construction, hydrostatic testing, and operation and maintenance of these pipelines. The operation and maintenance standards require periodic inspections to uncover potentially unsafe conditions, such as right-of-way infringements, eroded river crossings, and inoperative or defective corrosion prevention and detection equipment.

These regulations apply to each "person" who engages in the transportation of hazardous liquids or who owns or operates pipeline facilities. The definition of the term "person" in the authorizing legislation does not include the federal government, and the legislative history indicates that the law was not intended to apply to federally operated facilities.¹ Since DOE is in operational control and accepts responsibility for maintenance and safety of SPR pipeline facilities, DOT believes the SPR is not subject to its pipeline standards.

¹Hazardous Liquid Pipeline Safety Act of 1979 (49 U.S.C. app. 2001 (1)).

Although it is not required to do so, DOE attempts to comply voluntarily with these pipeline safety regulations in the operation and maintenance of all SPR oil pipelines. According to DOE officials, the criteria DOE developed to guide the design of SPR facilities state that the DOT pipeline safety standards must be followed in the design, construction, and operation of SPR facilities. These officials said that the pipeline construction contracts and the contract for maintenance and operation of the SPR require that contractors follow the design criteria containing the DOT standard compliance statements. However, DOE retains responsibility for assessing contractor activities and ensuring compliance with pipeline safety regulations.

Pipeline Problems Could Have Significant Impact

Potentially significant environmental impacts could result from the rupture of SPR pipelines. There are about 250 miles of SPR oil pipelines, ranging in size from 16 inches to 42 inches in diameter. During a drawdown at the current maximum rate, about 146,000 barrels of oil an hour would be pumped through the pipelines, including about 52,000 barrels an hour through the highest volume line. These pipelines traverse fragile Gulf Coast ecological areas. The swamps, marshes, and estuaries contain diverse varieties of fish and wildlife that support trapping, hunting, and recreational and commercial fishing.

Problems with SPR pipelines during a drawdown could have an even larger impact if they hindered the SPR's ability to serve its intended purpose. Previous oil supply interruptions illustrate the potential economic impact. For example, as we reported in 1985, the interruption of U.S. imports caused by the 1973-74 oil embargo and resulting oil price increase resulted in an estimated loss of \$35 billion to \$45 billion in Gross National Product and 500,000 jobs.

DOE Lacks Comprehensive Information on Contractor Compliance With Standards

Although DOE Project Office officials acknowledged that some of the pipeline corrosion and integrity problems previously reported may have been caused by noncompliance with the DOT standards, they believe that current SPR maintenance and operating activities are in compliance with the DOT pipeline safety regulations. At the time of our review, however, there was no focal point in DOE to determine and ensure compliance with the standards.

An Accident Investigation Board appointed by Oak Ridge to investigate a 1989 rupture of the Bryan Mound brine disposal pipeline recognized the need for such a compliance focal point. It recommended in August

1989 that DOE create a position in the Project Office with responsibility for overseeing all aspects of SPR pipeline operations, including compliance with applicable safety and environmental requirements. The Board Chairman told us that the Oak Ridge Manager approved this recommendation, and on October 5, 1990, the Assistant SPR Project Manager designated an SPR Pipeline Manager with responsibility for operation, maintenance, and construction of all SPR pipelines. According to SPR officials, the pipeline manager will also be responsible for ensuring compliance with the federal pipeline safety standards, but this was not mentioned in the appointment memorandum, and procedures for accomplishing this task have not yet been established.

SPR Not in Full Compliance With DOT Safety Standards

To check SPR compliance with the DOT standards, we selected nine requirements and reviewed the operating contractor's records to determine compliance with the requirements. We found the contractor had complied with six of the nine requirements in 1989. For the remaining requirements, we found the contractor did not perform required right-of-way and corrosion control equipment inspections as frequently as required and had not retained pipeline repair records for the useful life of the pipelines as required.

Pipeline Right-of-Way Inspections Did Not Comply With Standards

The DOT standards (49 C.F.R. 195.412(a)) require oil pipeline operators to inspect surface conditions of pipeline rights-of-way at least 26 times each calendar year at intervals not exceeding 3 weeks. According to the Project Office's Site Management Division Director, the contractor attempts to comply with this requirement by aerial inspections of the rights-of-way. Our review of overflight inspection records for 1989 showed that the contractor performed at least 26 inspections of each line during the year but did not comply with the 3-week interval requirement on any of the lines. During the first part of the year, periods ranging from 4 to 12 weeks elapsed without aerial inspections of the lines.

The Accident Investigation Board investigating the Bryan Mound brine line rupture also found flaws in the contractor's aerial pipeline inspection program. The Board found the operating contractor was not making aerial or ground right-of-way inspections as frequently as required by the contractor's own manuals and handbooks. Specifically, the Board found that the contractor

- allowed the pipeline overflight contract to expire and did not conduct inspections on a regular basis after the contract was extended, and
- failed to conduct the right-of-way land patrols required by the Off-site Pipeline Maintenance and Repair Handbook and the Security Operations Manuals when aerial patrols were not performed.

The Board concluded that the inspection program lacked senior management interest and recommended that the operating contractor (1) evaluate the pipeline surveillance program in writing on a regular basis and (2) ensure that aerial and ground inspections are made weekly with crews trained to recognize anomalies that threaten the pipelines and/or the environment.

In an October 1990 meeting to confirm the factual information in this report, SPR officials acknowledged previous problems but noted that they had acted in response to the Board's report by revising overflight procedures and replacing the contractor. Consequently, they reported that the 38 pipeline overflights conducted from March 13, 1990, to September 28, 1990, exceeded DOT standards.

Frequency of Pipeline Protection System Inspections Did Not Meet Standards

Paragraph 195.416(c) of the DOT standards requires owners of pipelines with cathodic protection systems to inspect the rectifiers—a key component of the cathodic protection system—6 times each year at intervals not exceeding 2-1/2 months.² Records provided by the operating contractor indicate that the rectifiers on four of the six pipelines requiring inspection had been inspected in accordance with the required standards. The rectifiers on the oil pipelines from the Bayou Choctaw and Weeks Island sites to the St. James terminal, however, were inspected only four of the required six times during 1989.

In our October 1990 meeting, SPR contractor officials also stated that they believed they had made the required inspections. They could not, however, provide the inspection reports.

²Cathodic protection is a technique to prevent the corrosion of a pipeline caused by a reaction between the pipeline and the surrounding soil and water.

Pipeline Repair Records Not Maintained as Required

Paragraph 195.404(c)(1) of the DOT standards requires operators to maintain, for the useful life of each pipeline, records showing the dates, locations, and descriptions of each pipeline repair. SPR oil pipelines are designed for a 20-year useful life. The operating contractor's maintenance director told us they keep such repair records for only 7 years. He also said that the pipeline repair records were commingled with repair records for all other SPR equipment and were not readily identifiable as pipeline repairs.

In our October 1990 meeting, SPR contractor officials claimed that repair records were kept permanently. Further discussion, however, revealed that this applied only to the computer records, not the source documents which contained detailed information on the repair. Further, work done by subcontractors was not consistently included in the computer records.

DOE Efforts to Ensure Integrity of SPR Pipelines

Because of the discovery of pipeline corrosion that raised questions about the structural integrity of some SPR pipelines, since the mid-1980s DOE has required the operating contractor to report periodically on the condition of the pipelines and recommend corrective actions when needed. These efforts, however, do not address the question of whether SPR operations are in compliance with the DOT standards.

Beginning in 1986 DOE directed the operating contractor to prepare Pipeline Integrity Reports describing each pipeline and any events, such as repairs and inspections, that occurred during the reporting period. The reports describe the condition of each line, including any operating limitations; discuss major repairs; and discuss the pigging³ and corrosion control monitoring program for each pipeline.

In July 1986 DOE also directed the operating contractor to develop a Pipeline and Piping Assurance Program to (1) identify the existing conditions of the pipeline system, (2) identify pipeline deficiencies that warrant correction, (3) make recommendations regarding required corrective actions, and (4) prepare a corrective action plan. The operating contractor inspected 635 field-site piping locations and identified 20 locations (3 percent) that it believed required either repair, definite replacement, or possible replacement. In March 1989 the operating contractor reported to DOE that the SPR site piping was in good condition

³Pigging means sending instruments (the "pigs") through the pipelines to check the pipeline electronically and identify the extent of corrosion.

with the exception of some brine and raw water lines. The report identified numerous repairs that must be made to give immediate and long-term assurance on the SPR piping, but it concluded that the pipelines would support required drawdown and fill rates in their current condition.

Conclusions

DOE attempts to comply voluntarily with the federal pipeline safety standards, and DOE and contractor officials believe they are in compliance. However, our review indicated that they have not always fully complied with some of the operations and maintenance requirements. DOE has taken action to require the contractor to periodically report on the condition of the SPR pipelines, but this does not address the issue of compliance with the DOT standards.

Although DOE is responsible for overseeing contractor activities and ensuring compliance with these standards, at the time of our review DOE did not have a focal point to collect and review such information. The October 1990 memorandum appointing the SPR pipeline manager did not specifically include responsibility for overseeing contractor compliance with federal pipeline safety standards, and detailed procedures for the position have not yet been developed. As a result, DOE lacks certainty that SPR pipelines will be properly maintained and protected from corrosion so that they can be relied on to function according to design standards during drawdown.

The serious environmental and economic impacts that could result from pipeline failures increase the level of confidence needed about the safety and reliability of the SPR pipelines. At a minimum, holding the SPR to the same standards required of commercial pipeline operators would increase that level of confidence.

Recommendation

To increase the certainty that SPR pipelines will operate safely and reliably as designed, we recommend that the Secretary of Energy direct the manager of the Oak Ridge Operations Office to assign specific responsibility for ensuring compliance with federal safety standards to the recently designated SPR Pipeline Manager and ensure that needed procedures and information systems are developed to monitor contractor operations.

Status of DOE's Actions on Previous GAO Recommendations

Our 1985 drawdown report, More Assurance Is Needed That Strategic Petroleum Reserve Oil Can Be Withdrawn As Designed, recommended four actions DOE could take to help ensure that the SPR system has the capability to provide a readily available supply of oil. We recommended (1) further testing of site drawdown capabilities, (2) testing water-system adequacy at two sites to support drawdown rates, (3) resolving piping integrity and corrosion control concerns, and (4) satisfactorily completing ongoing work on the automated control systems and integrated logistics support system. DOE's implementation of our recommendations provides greater assurance the SPR oil can be successfully withdrawn during an emergency.

Drawdown and Water System Tests Usually Met Objectives but Identified Some Problems

Our previous report questioned drawdown capabilities in part because DOE had not conducted comprehensive oil drawdown tests at each storage site or completed water system modifications necessary to move the amount of water required for drawdown. We recommended that DOE (1) conduct further tests to allow an assessment of drawdown capability and (2) after completing modifications underway, test water systems to ensure that drawdown capability was not limited by inadequate water supplies.

Additional Tests Provide Better Basis for DOE's Estimated Drawdown Rates, but Concerns Remain

DOE has taken some action to respond to our 1985 recommendation that it conduct further tests of the SPR to allow an assessment of its capability to meet design drawdown goals. From 1986 through 1989 DOE conducted 20 oil movement, water flow, and other system tests to assure itself oil could be withdrawn as designed from SPR sites. Eleven tests involved oil movements, and at least one maximum rate drawdown test was conducted at each site, other than Big Hill. Although some of the 20 tests encountered problems, they usually met most of the test objectives that DOE established.

We also pointed out that the limited duration of these tests left a degree of uncertainty as to whether DOE will be able to sustain these rates over the extended periods required during an energy emergency. In the 1985 report, we pointed out that while the 1-day tests conducted by DOE showed that oil can be withdrawn from the SPR, they provided only limited confidence that the SPR will be able to achieve its drawdown goals. We noted that, although the duration of a test that would stress the system has not been defined, engineers familiar with the SPR or comparable oil industry equipment have indicated that a 5- to 7-day test would be reasonable. The tests conducted by DOE after 1985 were still of short

duration, with most lasting less than a day. For example, one of the objectives of an April 1989 test at Bayou Choctaw was to demonstrate that the site could draw down at a rate of 505,000 barrels per day. During the test the 505,000-barrels-per-day rate was achieved and sustained for 20 minutes. The test as a whole lasted about 6-1/2 hours and moved just over 3,000 barrels of oil.

The Director of DOE's SPR office does not believe longer tests are warranted because engineering and scientific analysis of the tests provide adequate assurance that drawdown goals will be met. He also said that there would be no place to move the quantity of oil involved in an extended drawdown test without affecting the market and disrupting ongoing commercial oil movement operations. Further, full-scale drawdown causes wear and tear on equipment. While we understand the Director's concerns, more extensive testing will decrease the uncertainty regarding the SPR's drawdown capabilities.

On September 27, 1990, DOE announced a sale of 5 million barrels of oil (as authorized by the Energy Policy and Conservation Act Amendments of 1990) to test the SPR and allow the private sector to increase its familiarity with the SPR distribution process. DOE expects to deliver the entire 5 million barrels over a 30-to-45-day period.

Table 4.1: Type of SPR Drawdown Tests Conducted Between 1986 and 1989 and Extent Stated Objectives Were Achieved

	Number of tests	Time frame	Number of objectives met	Number which met all objectives
Oil movement tests	11	Apr. 1986 to Oct. 1989	54 of 63 (86%)	8 of 11 (73%)
System tests	9	Oct. 1986 to Oct. 1989	40 of 42 (95%)	7 of 9 (78%)
Total	20		94 of 105 (90%)	15 of 20 (75%)

Drawdown Enhancements Should Ensure Ability to Achieve Overall Drawdown Rate

Results of the drawdown tests led DOE to conclude that four of the five present sites—Weeks Island, Bayou Choctaw, West Hackberry, and Sulphur Mines—could meet their designed drawdown rates, but that the remaining site—Bryan Mound—had problems meeting its planned rate. As discussed in chapter 2, DOE initiated enhancements to correct this shortfall and allow them to increase Bryan Mound's drawdown capacity.

DOE Initiated a Program to Identify and Correct Pipeline Corrosion Problems

Our previous report discussed corrosion problems identified at some sites and raised questions about the integrity of the piping and pipeline systems if the problems were not corrected. We recommended that DOE (1) assess the integrity of its piping/pipelines to withstand pressures needed to move the oil at maximum drawdown rates and (2) protect piping/pipelines from future corrosion.

As discussed in chapter 3, DOE directed its operating contractor to prepare a periodic Pipeline Integrity Report and initiate a Pipeline and Piping Assurance Program to assess piping conditions and ensure that the pipelines would meet drawdown and fill requirements.

Installation of Automated Instrumentation and Control Systems Completed Late

Our 1985 drawdown report discussed the numerous delays DOE experienced in completing the automated instrumentation and control systems at each site. These automated controls, which are designed to open and close valves, start and stop pumps in the proper sequence, and monitor and control sensory devices on field equipment from a central control room, were not fully operational at all sites when we issued our report. Although these systems are not essential for drawdown, we believed their completion would increase confidence that a drawdown could be safely sustained. We recommended that DOE ensure that ongoing work on these systems was satisfactorily completed and that the systems functioned as designed.

According to the DOE Project Office engineer overseeing installation, the automated systems in process at the time we reported have been completed and work acceptably. He added that DOE installed additional automated control systems to accommodate additional caverns constructed after our report at West Hackberry, Bryan Mound, and Bayou Choctaw and all caverns at Big Hill. These systems also suffered installation problems and considerable delays, but they were completed and accepted by DOE in early 1990.

Basic Integrated Logistics Support System Now in Place

Our previous report discussed delays that DOE experienced with the contractor in trying to develop an integrated logistics support system for the SPR to ensure an adequate supply of spare parts for a sustained drawdown. Logistics support is the system of procuring, maintaining, storing, and controlling materials and equipment needed to keep a project such as the SPR operational. Such a system ensures that spare and

repair parts, support equipment, tools, warehousing, technical documentation, computerized inventory control systems, and associated personnel are in place when needed. We concluded that DOE needed to complete the support system as soon as possible and recommended that DOE ensure that the ongoing work on the system was completed and that the system functioned as designed. According to DOE officials, an acceptable support system is in place and functioning. In addition, the operating contractor and a subcontractor have studied the support system and identified refinements to improve it.

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Related GAO Products

Oil Reserve: DOE's Management of the Strategic Petroleum Reserve
(GAO/RCED-87-171BR, July 17, 1987).

The Strategic Petroleum Reserve: An Overview of Its Development and Use in the Event of an Oil Supply Disruption (GAO/RCED-85-134, Sept. 30, 1985).

More Assurance is Needed That Strategic Petroleum Reserve Oil Can Be Withdrawn as Designed (GAO/RCED-85-104, Sept. 27, 1985).

Evaluation of the Department of Energy's Plan to Sell Oil from the Strategic Petroleum Reserve (GAO/RCED-85-80, June 5, 1985).

Analysis of Oil Withdrawal and Distribution Tests for the Strategic Petroleum Reserve (GAO/RCED-85-115, May 8, 1985).